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IS 4410-23 (1999): Glossary of Terms Relating to River Valley Projects, Part 23: Hoists, Cranes and Other Related Terms [WRD 12: Hydraulic Gates and Valves]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 4410 (Part 23) : 1999

(Reaffirmed 2004)

भारतीय मानक

नदी घाटी परियोजना से संबद्ध परिभाषिक शब्दावली

भाग 23 हाइस्ट, क्रेन तथा अन्य संबद्ध शब्दावली

Indian Standard

GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

PART 23 HOISTS, CRANES AND OTHER RELATED TERMS

ICS 93.160:01.040.93

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

March 1999

Price Group 10

FOREWORD

This Indian Standard (Part 23) was adopted by the Bureau of Indian Standards, after the draft finalized by the Terminology Relating to River Valley Projects Sectional Committee had been approved by the River Valley Division Council.

A large number of Indian Standards have already been printed covering various aspects of river valley projects and some more standards are in the process of formulation. These standards include technical terms, the precise definitions of which are required to avoid ambiguity in their interpretation. To achieve this aim the committee is bringing out this standard in various parts.

This standard has been brought out to cover the definitions of types of hoists, cranes and related terminology used in river valley and hydropower projects. The hoists included in this standard are popularly adopted in India. Terminology related to them is also covered broadly. However there could be some more types of hoists which do not find mention herein. As such this standard may be adopted only for the purpose of providing general guidelines and for knowing terms broadly.

Indian Standard

GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

PART 23 HOISTS, CRANES AND OTHER RELATED TERMS

1 SCOPE

This standard (Part 23) covers the definition of the terms relating to hoists, cranes and other related terms used in river valley and hydropower projects.

2 REFERENCES

The standards given below are necessary adjuncts to this standard :

<i>IS No.</i>	<i>Title</i>
800 : 1984	Code of practice for general construction in steel (<i>second revision</i>)
807 : 1976	Code of practice for design, manufacture, erection and testing (structural portion) of canes and hoists (<i>first revision</i>)
3177 : 1977	Code of practice for electric overhead travelling cranes and gantry cranes other than steel work cranes (<i>first revision</i>)

3 TERMINOLOGY

3.1 Hoist

An appliance whose principal function is raising and lowering of loads. It covers all kinds of hoists such as hand operated portable hoist, rope drum hoist, chain and sprocket type hoist, screw hoist, hydraulic hoist, etc.

3.2 Hand Operated Portable Hoists

These hoists are employed where regular hoists are not required to be provided and the hoisting efforts required are low. Chainpulley blocks, chain operated portable worm-gear hand hoists and winches are three common types of such hoists.

3.3 Chain Pulley Block

It is a manually operated hoist in which mechanical advantage is obtained by number of falls of chain connecting the load pulleys and the fixed pulleys. It is also known as spur gear type portable hand hoist. It is required to be suspended from a fixed support for operation (see Fig. 1).

3.4 Chain Operated Portable Worm-Gear Hand Hoist

Hand hoist in which the worm is driven by a chain pulley system and the worm wheel is driven by the worm by which the chain is moved up and down to raise or lower the load.

3.5 Winch

Mechanism which transmits pull by means of a flexible element such as rope or chain from a power driven drum. These are of drum, friction or capstan type.

3.6 Rope Drum Hoist

In this type of hoist, the load is suspended from the wire ropes wounding/unwounding on guided grooves of a drum resulting in the raising/lowering the load. These may be manually operated or electrically operated depending on the requirement and availability of power. This type of hoist is provided in monorail, H.O.T crane, E.O.T crane, gantry crane, etc.

3.7 Electric Wire Rope Hoist

This type of hoist is having wire rope between the rope drum and the lifting hook. The various types are as under:

- Base mounted hoist* — It is an electric wire rope hoist similar to an overhead electric hoist except that it has a base or feet and may be mounted overhead in a vertical plane or any position for which it is designed.
- Hook suspended hoist* — An electric wire rope hoist where upper suspension member is a hook.
- Lug suspended hoist* — An electric wire rope hoist where upper suspension members are lugs.
- Trolley suspended hoist* — An electric wire rope hoist whose upper suspension member is a trolley for the purpose of running the hoist below a suitable runway.

3.8 Chain and Sprocket Type Hoist

In this type of hoist, the load is suspended from a chain, which can be rotated by a sprocket or chain guide by means of a hand drive or an electric drive. For low

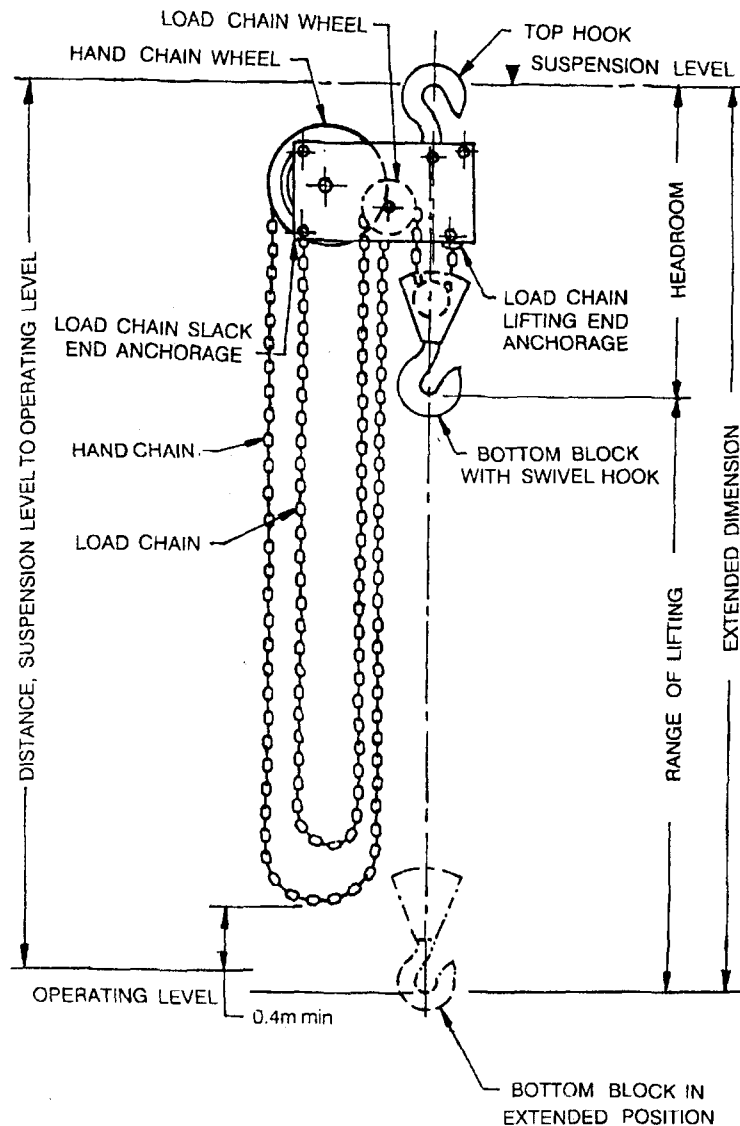


FIG. 1 CHAIN PULLEY BLOCK

capacity, welded chain can be used but for high capacity, roller chain has to be used.

3.9 Screw Hoist

Screw hoist is nothing but a lifting nut rotating on a threaded stem. When the stem is connected with the gate and laterally held, lifting nut is rotated. The stem moves up and down causing raising and lowering of the gate. Since in this type of arrangement the stem moves up while raising the gate, the screw hoist is called rising stem type (see Fig. 2 and Fig. 3).

In the second arrangement nut can be fixed to the gate and rotation of laterally constrained stem would cause raising or lowering of the gate. In this case nut rides over the stem and stem does not move up and down and hence such type of screw hoist is called non-rising stem type.

3.10 Hydraulic Hoist

In this type pressurised fluid is pumped into a cylindrical shell on one side of the piston. The translation of the piston in the cylinder causes operation of the gate, connected to the piston stem when the cylinder is firmly held.

Alternatively the gate may be connected to the cylinder and the piston stem can be tightly held. In this case the cylinder moves along with the gate.

A hydraulic hoist can be single cylinder or double cylinder depending on the requirement (see Fig. 4 and Fig. 5).

3.11 Crane

Cyclic action machine intended for hoisting and moving in space of a load suspended by means of a hook or other load-handling device.

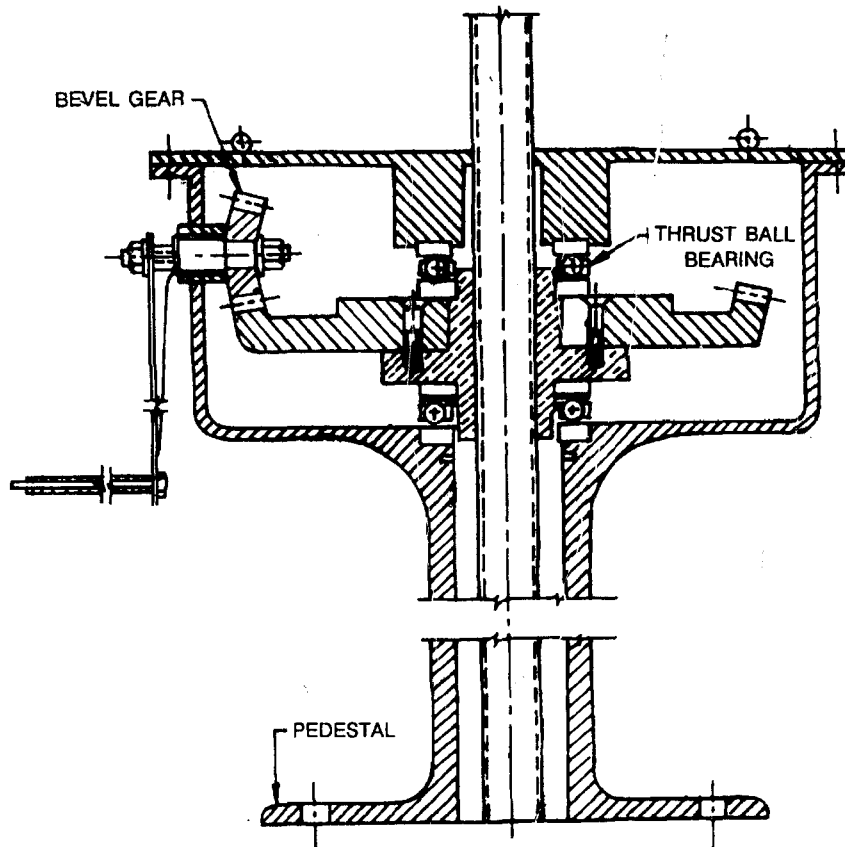


FIG. 2 TYPICAL ARRANGEMENT FOR A HAND-OPERATED SCREW HOIST (CLASS-SECTION)

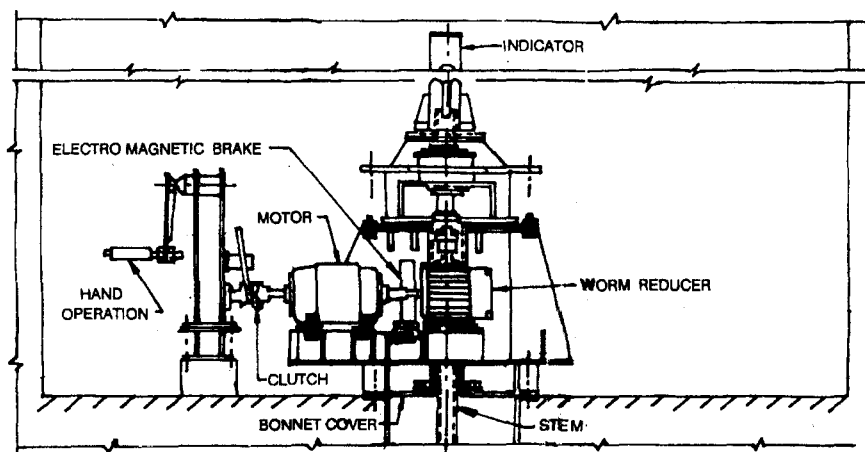


FIG. 3 TYPICAL ARRANGEMENT OF MOTOR DRIVEN SCREW HOIST (SIDE VIEW)

3.12 Overhead Travelling Crane

Overhead travelling crane consists essentially of a girder (or girders) attached at each end to carriages, travelling along elevated tracks fixed in location, and a trolley or crab equipped with a hoisting mechanism travelling along such girder (or girders). Such cranes include overhead travellers with double trolleys or

with an under slung jib, overhead charging machines, soaking pit strippers, ladle or magnet cranes or other similar type (*see* Fig. 6A and 6B).

3.13 Single Girder Crane

A crane which has a single girder spanning the gantry. The beam, which is rigidly connected to the end

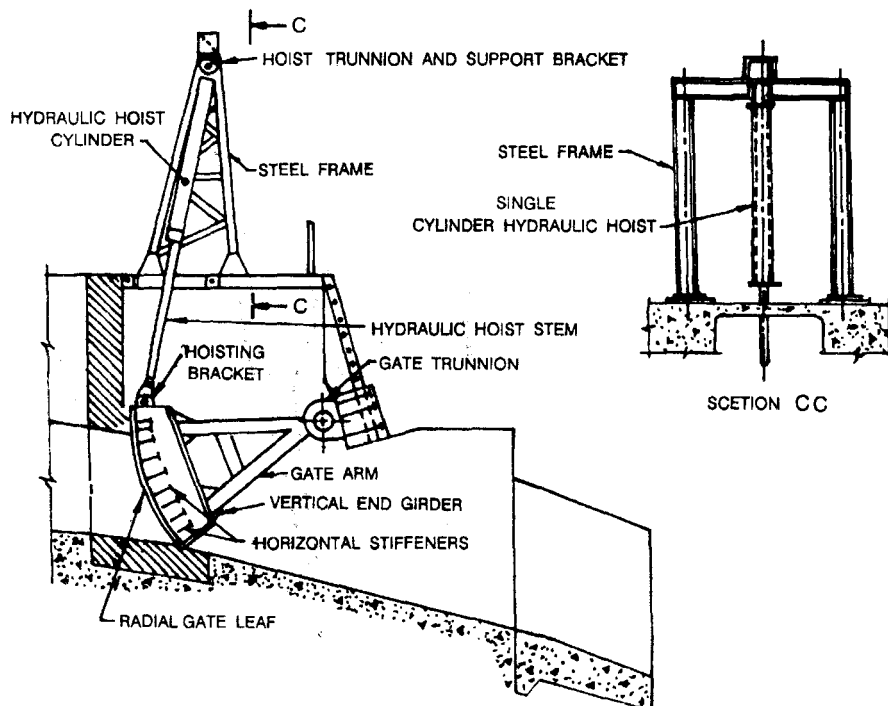


FIG. 4 SINGLE CYLINDER TYPE HYDRAULIC HOIST FOR RADIAL GATE

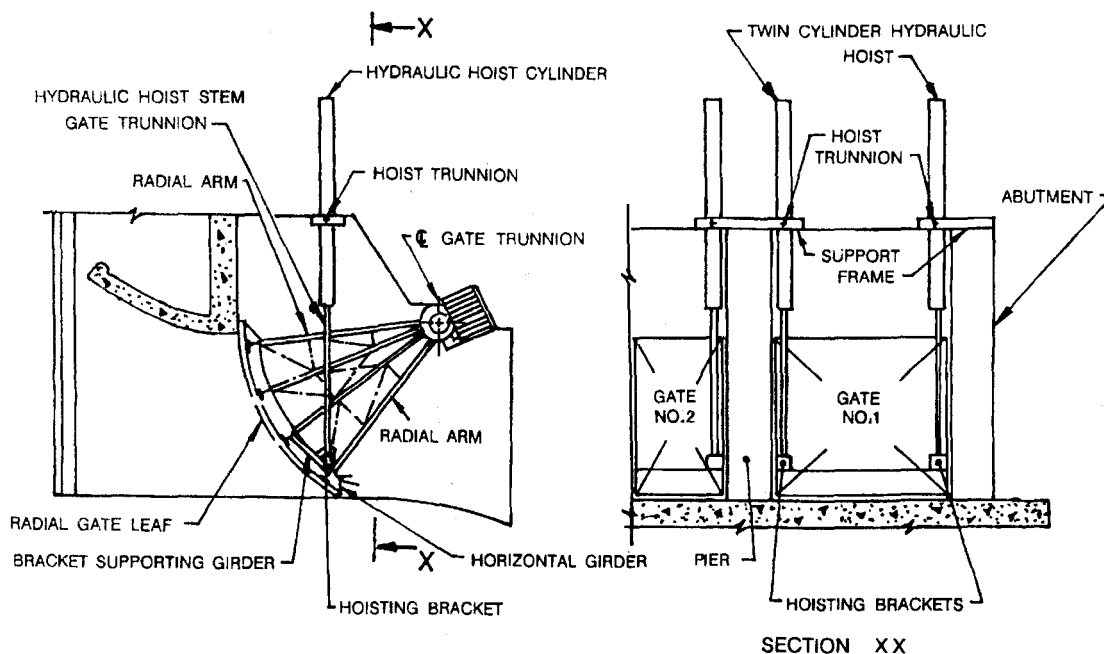
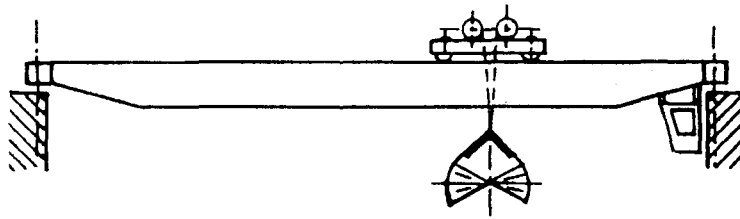


FIG. 5 TWIN CYLINDER TYPE HYDRAULIC HOIST FOR RADIAL GATE

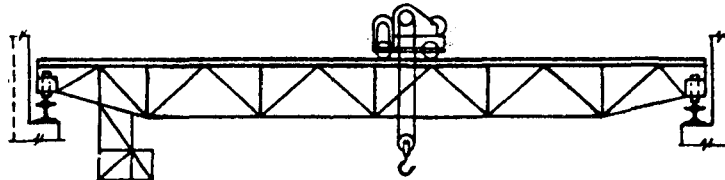
carriage, supports the load trolley and block. The travelling end carriage wheels run directly over the gantry girders normally on additional rails secured to the girder (see Fig. 7).

3.14 Double Girder Crane

A crane which has two parallel girders rigidly connected to the end carriages and spanning the gantry. The lifting unit is built on to a traversing crab



6A Overhead Travelling Grabbing Crane



6B Electric Overhead Travelling Crane

FIG. 6 OVERHEAD TRAVELLING CRANE

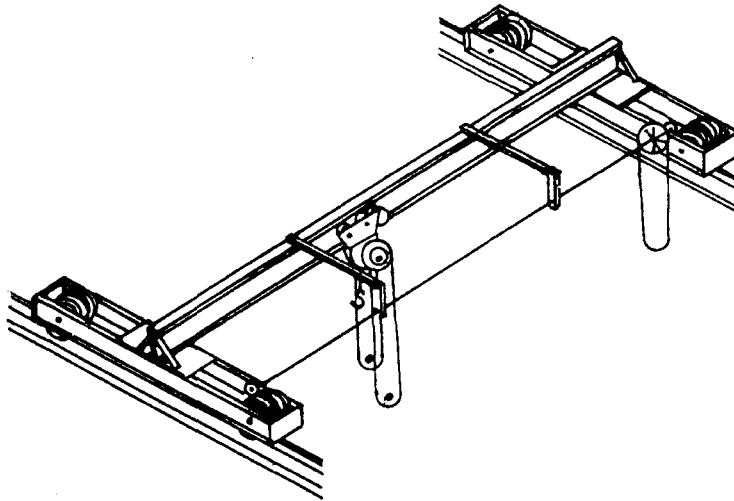


FIG. 7 SINGLE GIRDER CRANE

either overslung or underslung from the beams (see Fig. 8).

3.15 Overslung Crab

A crab in which the wheels run directly over the crane girder (see Fig. 9).

3.16 Underslung Crab

A crab in which the wheels run on the lower flanges of the gantry girders.

3.17 Suspension Crane

An overhead crane travelling on a suspended track. The crane comprises of underslung type end carriages supporting the girder with hoisting, traversing and travelling motions.

3.18 Suspension Track

Crane track suspended from elevated steel girders fixed to the overhead structures. The tracks may be straight or curved.

3.19 Stacking Crane or Suspended Mast Crane

A powered overhead travelling crane where the crab carries an inverted mast. The load is carried on forks or other attachments mounted on the carriage arranged to travel up and down the mast. The mast is also capable of rotating around the vertical axis. The control of the crane can either be through the medium of a pendant push button from a cab carried from the mast or mounted on the carriage.

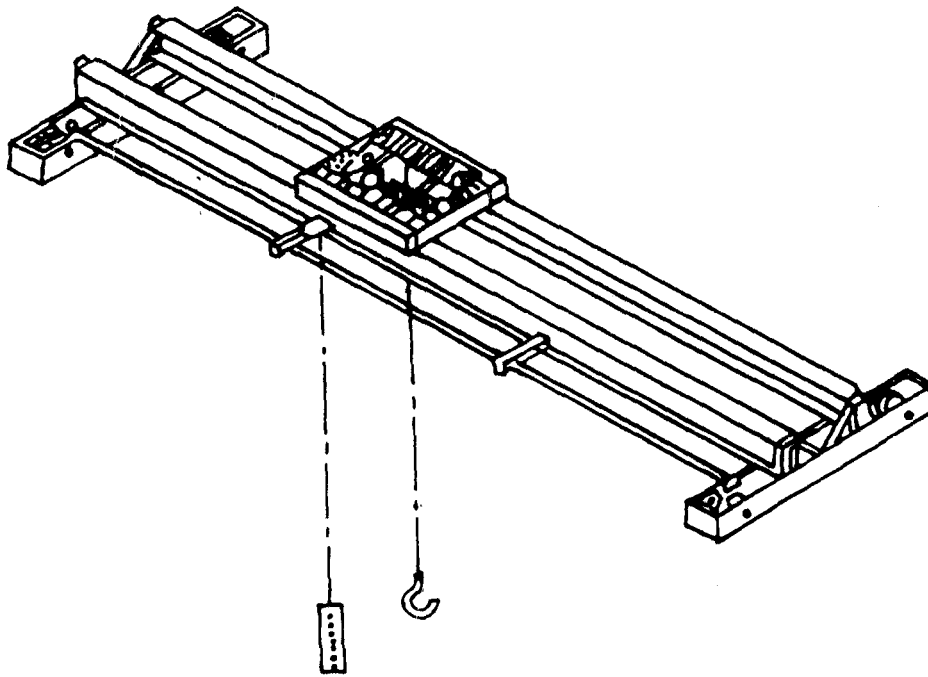


FIG. 8 DOUBLE GIRDER CRANE

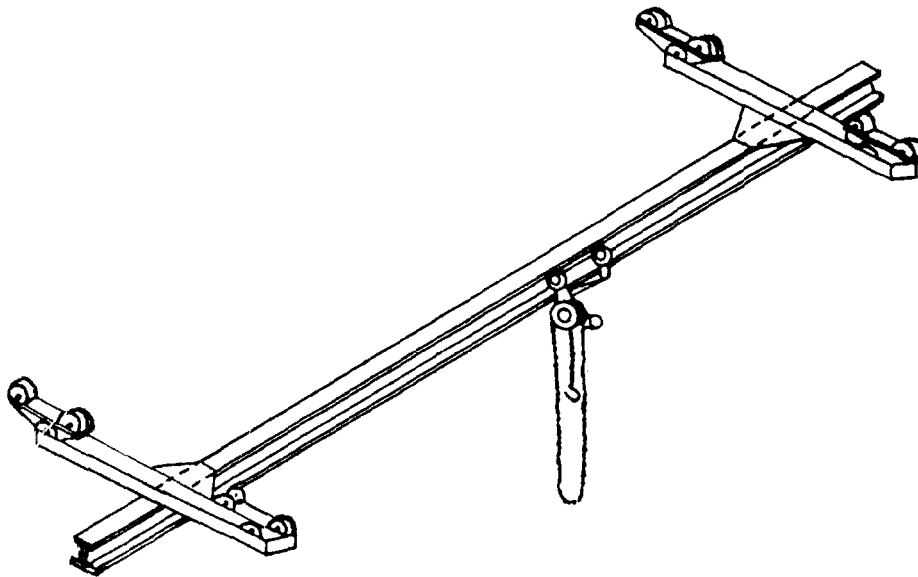


FIG. 9 OVERSLUNG CRANE

3.20 Jib Crane

Jib crane used in conjunction with a hoisting mechanism, consists essentially of a structure member of a jib, horizontal or inclined, capable of carrying a load at its outer end, the jib being supported by a compression member or tension member or a combination of both, a rope being considered a member. Such cranes include scotch or stiffleg derricks, guy derricks, locomotive pedestal, travelling,

wall, roofs, luffing bicycle or monorail jib, floating cranes, floating shearlegs and other similar types (*see* Fig. 10).

3.21 Portal Crane

Portal crane is a fixed or revolving type jib crane mounted upon a portal frame fixed in location or to travel along a fixed track of the rails at the same level, the portal frame consisting essentially of horizontal

girders connected at both ends to vertical or inclined members of the same length. Such cranes include some types of wharf cranes and shipyard (tower crane).

3.22 Semi-Portal Crane

Semi-portal crane is fixed or revolving type jib crane mounted upon a semi-portal frame fixed in location or arranged to travel along a fixed track of rails at different levels, the semi-portal frame consisting essentially of horizontal girders connected at both ends to vertical or inclined members of different lengths, of which the shorter members may consist only of the

trolley running along the elevated rail (*see* Fig. 11A and 11B).

3.23 Derrick or Ginpole

Derrick or ginpole is a strut with guys so arranged as to permit the inclining of the strut in any direction, the load being raised or lowered by a hoisting mechanism.

3.24 Guy Derrick Crane

Guy derrick is a structure consisting of mast capable of being rotated and supported in a vertical position by not less than six guys. The mast carries a jib, the head of which is tied to the mast, the load being raised or lowered by a hoisting mechanism (*see* Fig. 12).

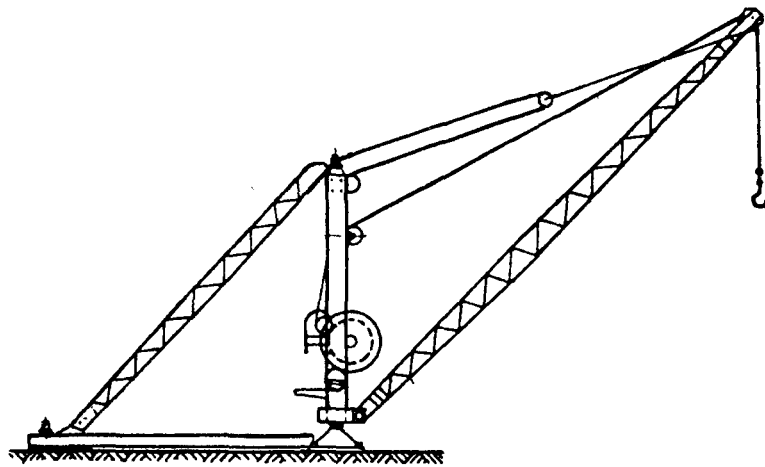
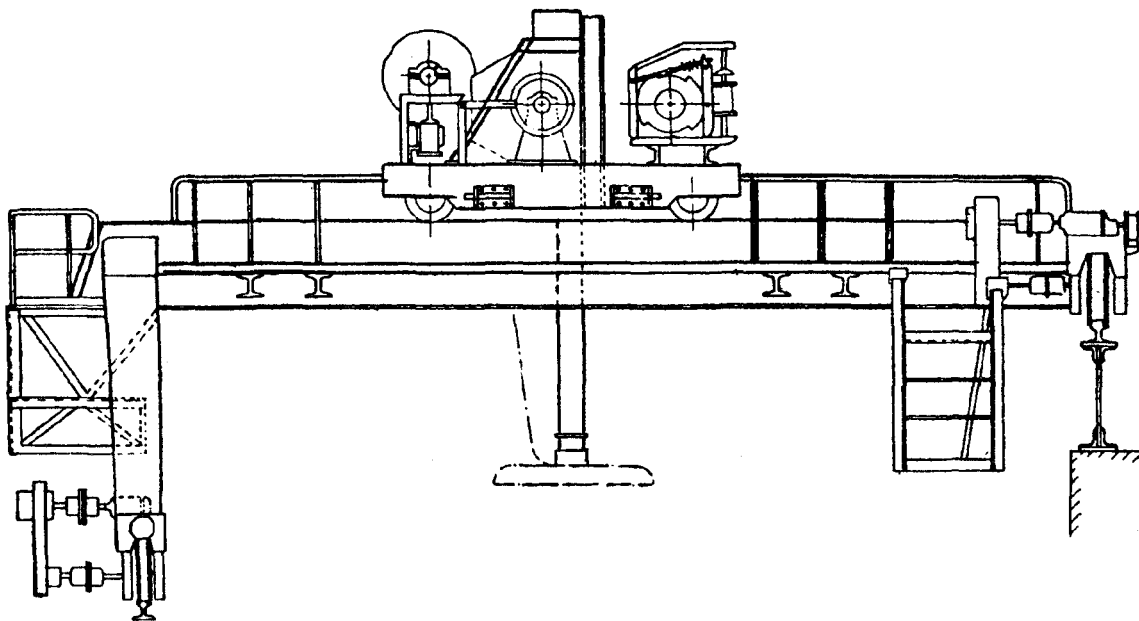
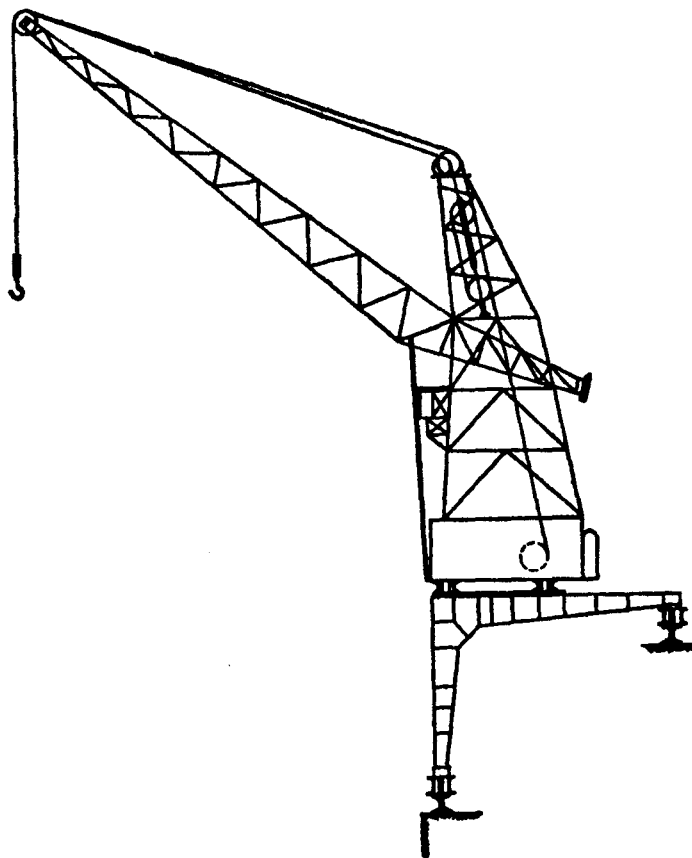


FIG. 10 JIB CRANE (HAND-OPERATED SCOTCH DERRICK TYPE)



11A Semi-portal Crane (Continued)



11B Semi-portal Wharf Crane

FIG. 11 SEMI-PORTAL CRANES

3.25 Stiffleg (Builders) Derrick

Stiffleg (builder's) derrick is a crane consisting of a mast, a jib connected to the base of the mast and hoisting mechanism with the additional motions of slewing and (but not necessary) luffing the jib. The top of the mast is generally supported by two rigid inclined members (back legs) normally connected to the lower support of the mast by horizontal members (sleepers).

3.26 Post Crane

It is a crane fixed in position and consisting of a vertical member supported at the top and bottom, a horizontal member rigidly connected to it and a hoisting mechanism, the whole being capable of being slewed. The hoisting mechanism may be arranged to operate at fixed or variable radius along the horizontal member (*see* Fig. 13).

3.27 Tower Crane

It is a crane of the fixed or travelling type which by virtue of the height of its supporting tower frame is capable of hoisting, luffing and slewing its load over high obstruction. The crane may be supported upon

and obtain its slewing motion from a slewing ring mounted upon tower, or from a revolving member or a footstep bearing within the tower (*see* Fig. 14).

3.28 Locomotive Crane

Locomotive crane is a crane having a specially designed wheel mounted frame carrying a superstructure capable of slewing in either direction under load. The crane shall be capable of travelling under its own power along a railway track with speed limitation, if the load is suspended at any position within its area of slewing. The larger cranes of this type, used for railway salvage purposes are generally provided with outriggers (*see* Fig. 15).

3.29 Shear Legs

Shear legs are a pair of compression members inclined towards each other, rigidly connected at their upper ends fixed in position, but not in direction at their lower ends and held in an inclined position fixed or variable, by ties and provided with a hoisting mechanism. Their principle function is raising and lowering of loads, but may include a limited luffing motion. They may be fixed or mobile (including pontoon mounted).

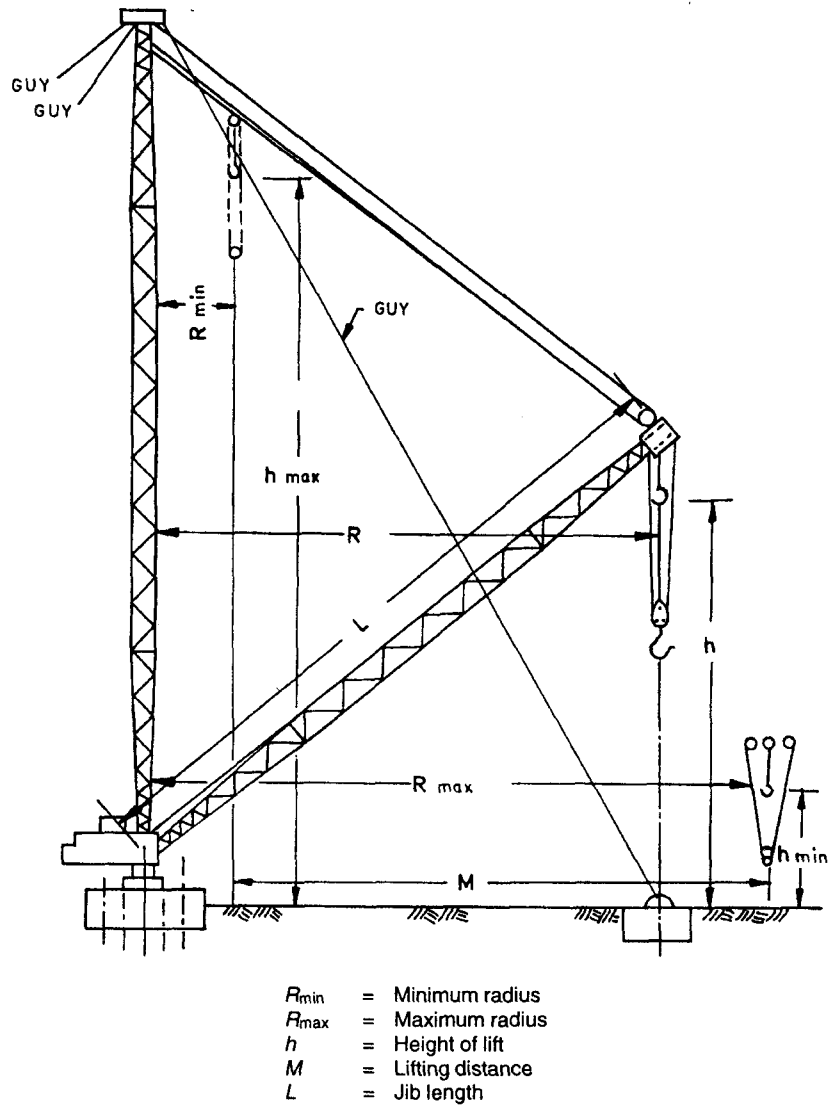


FIG. 12 HAND-OPERATED GUY DERRICK CRANE

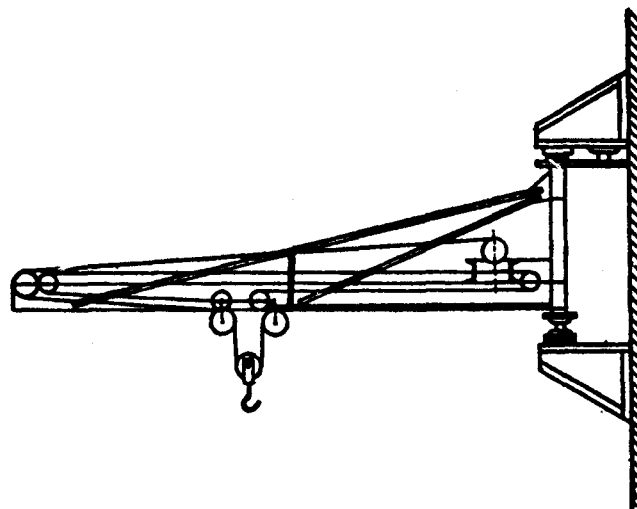


FIG. 13 POST CRANE (SWING JIB TYPE)

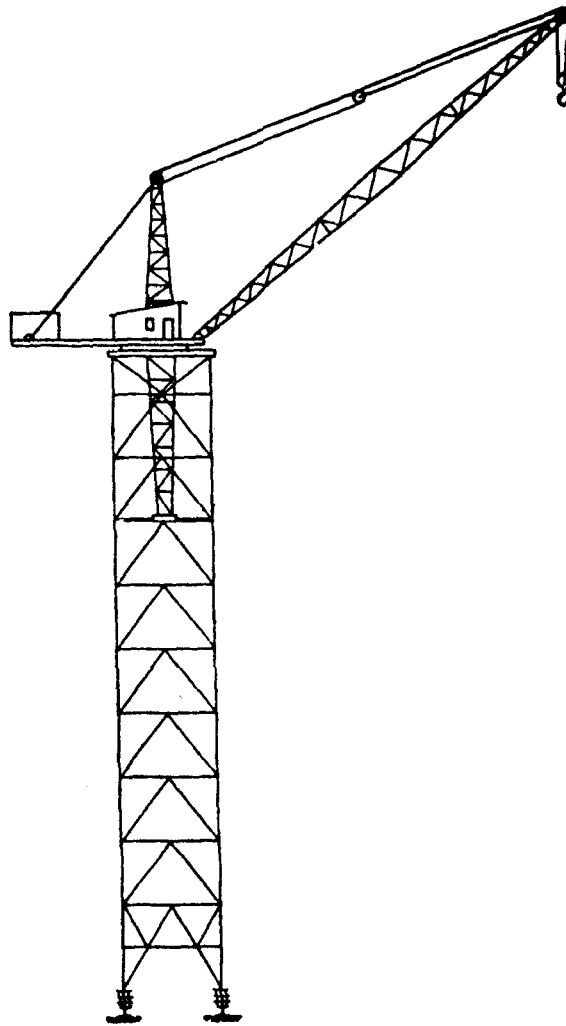


FIG. 14 TOWER CRANE (OR TOWER DERRICK CRANE)

3.30 Dockside or Wharf Crane

A jib crane designed for loading and unloading in dockside or wharfs, consisting of a full portal or semi-portal, fixed or rail mounted gantry, supporting a revolving superstructure and jib or a cantilever (*see* Fig. 16).

3.31 Scotch Derrick Crane

A jib crane consisting of a part slewing king post supporting jib and driving mechanism secured by back stays, the top of the king post being secured to the stays by tie members (*see* Fig. 10).

3.32 Gantry Crane

Gantry crane is essentially an elevated horizontal runway girder (or girders) connected at or near both ends to vertical or inclined member fixed in location, or arranged to traverse along a fixed track and having mounted on the girder (or girders) a trolley or crab equipped with a means for hoisting and capable of

travelling along the girder (or girders). In addition to the usual type of gantry crane, cranes such as the Goliath with cantilever arms, the bridge type with overhung cantilever, radial and stationary transporters, or bridges and other like appliances are covered by this definition. (*see* Fig. 17).

3.33 Cantilever Crane

Cantilever crane consists essentially of a vertical and horizontal structural members, equipped with a hoisting mechanism fixed to the horizontal member, or a trolley or crab equipped with a hoisting mechanism travelling along such horizontal member. The horizontal member may be fixed to or rotate about the axis of the vertical member with its support arranged substantially through such axis. The crane as a whole may be fixed in location or arranged to travel along a fixed track. Such cranes include the hammerhead, revolving cantilever, foundry wall cranes and other similar types (*see* Fig. 18).

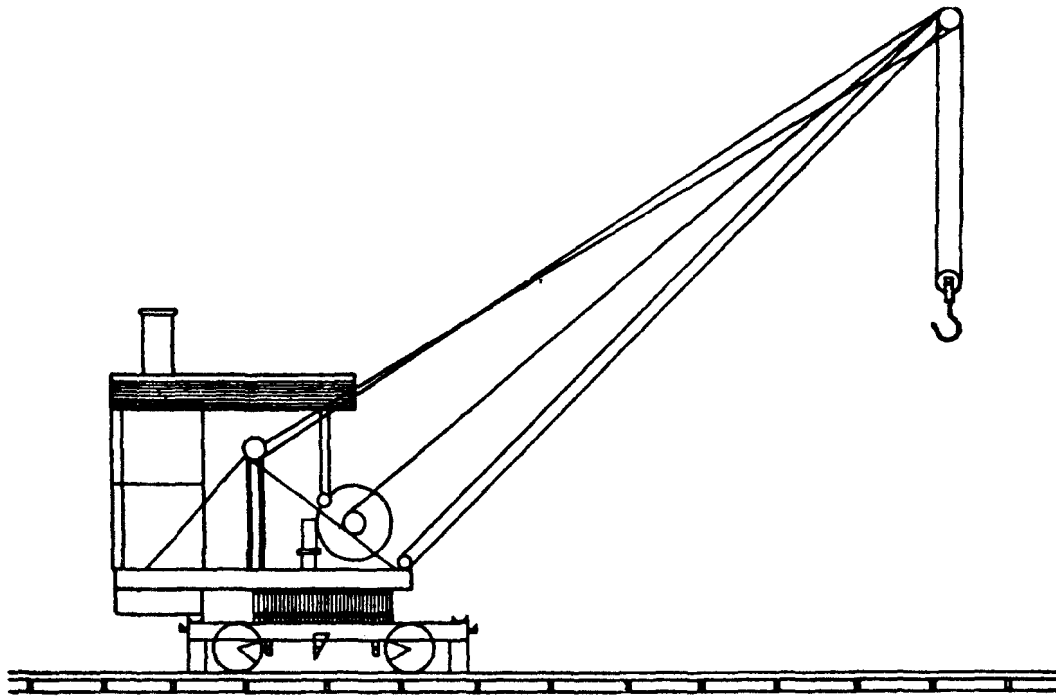


FIG. 15 LOCOMOTIVE CRANE ON RAILS

3.34 Goliath Crane

This type of crane is generally mounted on legs which have necessary end carriages with long travel wheels. These cranes run on rails fitted on the ground (see Fig. 17 and 19).

3.35 Transporter Crane

A crane consisting of a rail mounted gantry supporting a traversing crab containing the traversing and hoisting motions. This crane is operated from a fixed or crab mounted cabin.

3.36 Transporter Grabbing Crane/Unloader

This crane is normally designed for high capacity, bulk unloading of ships, consisting of a rail mounted gantry normally containing a hopper or hoppers and supporting a hinged horizontal beam that may be raised. This crane is normally operated from a crab mounted cabin.

3.37 Container Handling Crane

A transporter crane incorporating container handling device. The crane is operated from a crab mounted cabin. For decks side applications, hinged horizontal boom that may be raised is normally incorporated.

3.38 Mobile Crane (Power Driven)

Mobile crane (power driven) includes all types of travelling jib crane such as road wheel mounted, off-the-road wheel mounted or caterpillar tracked and

capable of raising and/or lowering a load and travelling under its own power with speed limitations if the load is suspended. (Lift trucks are not to be included under this definition.)

3.39 Wheel Mounted, Fully Mobile Crane

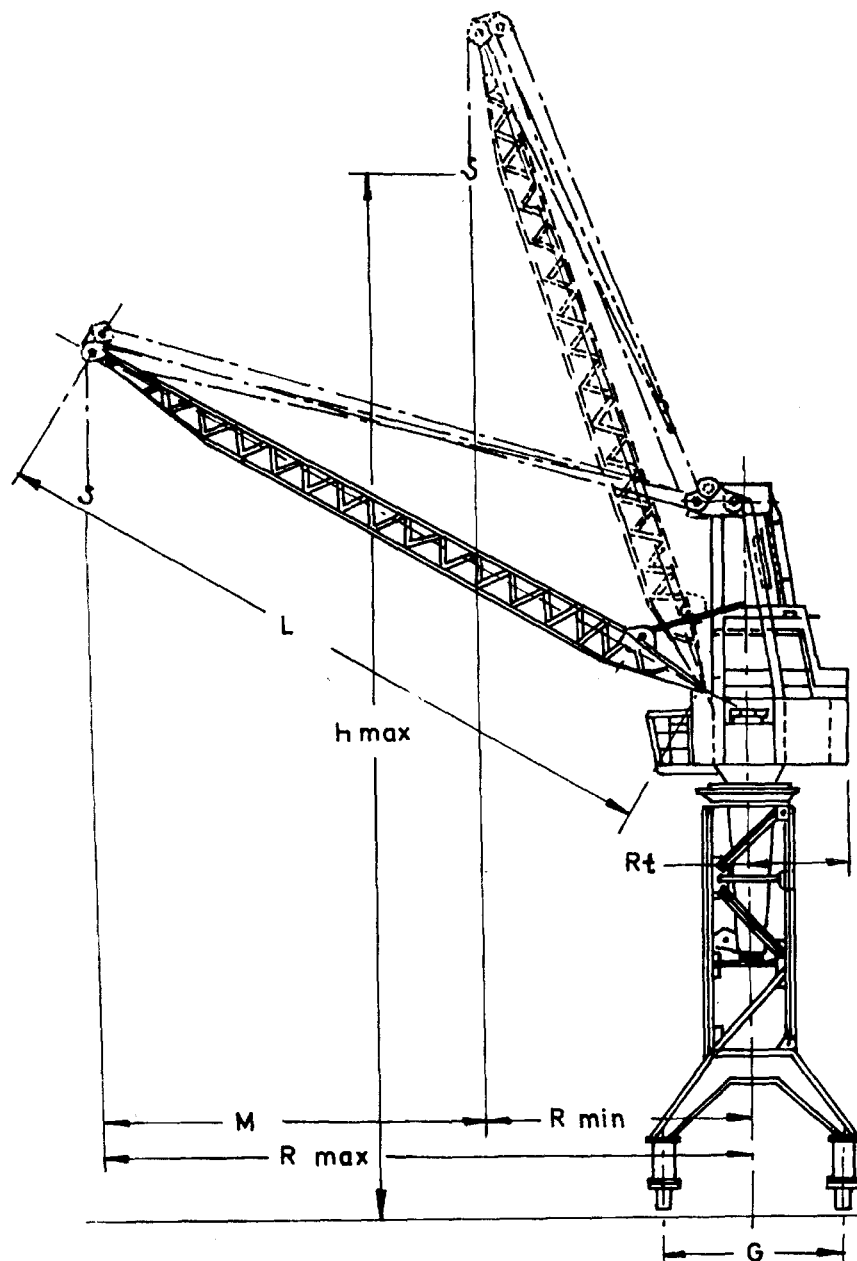
A crane having a superstructure mounted on a heavy framed rubber tyred carrier supported by two or more axles. The carrier is generally driven by the engine on the superstructure, but may have a separate engine. The crane may be fully slewing, part slewing or non slewing type.

3.40 Truck Mounted, Fully Mobile Crane

A crane having a superstructure mounted on a heavy frame rubber tyred carrier supported by two or more axles having the general characteristics of a heavy duty truck. Over the road travel is normally controlled from a cab mounted on the carrier. It generally has separate engines for carrier and crane superstructure. The carrier is generally fitted with outriggers or jacks to lift loads in excess of those permitted free on tyres. The crane may be fully slewing, part slewing or non-slewing type.

3.41 Crawler Mounted, Fully Mobile Jib Crane

A crane having a superstructure mounted on two continuous parallel crawler tracks, each consisting of a series of shoes or links and controlled and powered from the superstructure. The crane is generally of the fully slewing type.



G	=	Wheel centres	M	=	Luffing distance
R_{Min}	=	Minimum radius	h	=	Height of lift
R_{Max}	=	Maximum radius	L	=	Jib length
R_t	=	Tail radius			

FIG. 16 DOCKSIDE OR WHARF CRANE

3.42 Rail Mounted, Self Propelled, Non-Shrinking Jib Crane

A crane having a superstructure mounted on a low carriage supported by two or more axles fixed with rail wheels, the carrier is driven by the engine of the superstructure and is not suitable for shunting main

line wagons. The crane may be fully slewing or part slewing type.

3.43 Rail Mounted, Self Propelled, Shunting Jib Crane

A crane generally similar to the above non-shunting type, primarily intended for crane duty but having an

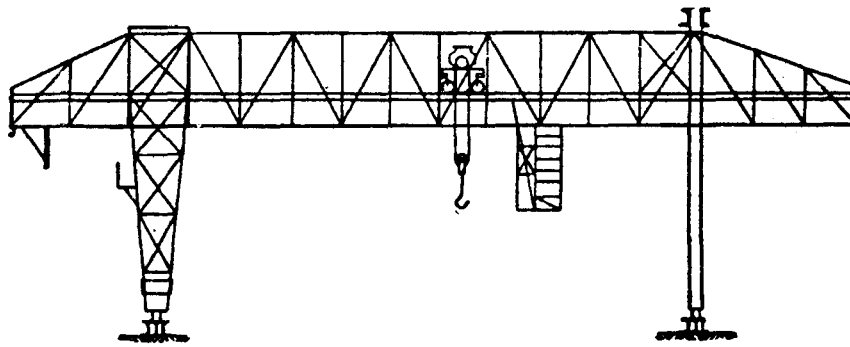
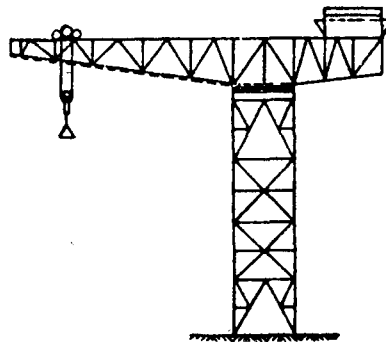


FIG. 17 GANTRY CRANE (GOLIATH WITH CANTILEVER CRANE)



(Rotating Hammerhead Type also known as Monotower Crane)

FIG. 18 CANTILEVER CRANE

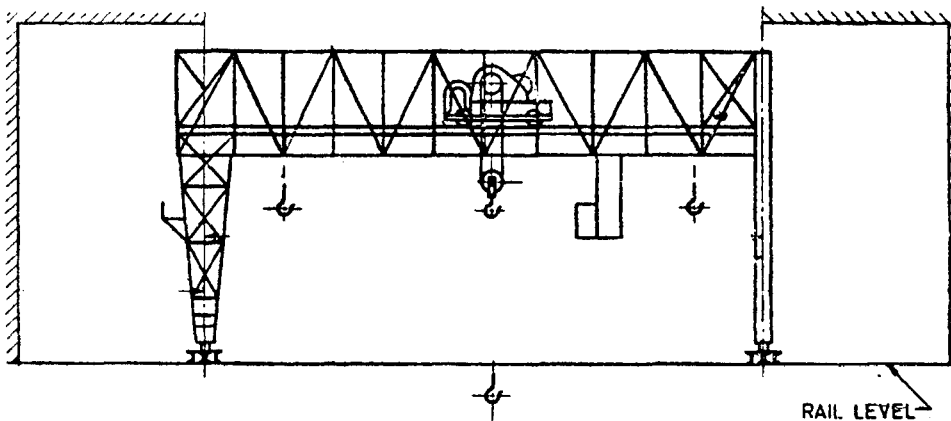


FIG. 19 GOLIATH CRANE WITHOUT CANTILEVER ARMS—CLEARANCE DIAGRAM

extended carriage with head-stocks suitable for shunting main line and having travelling gear suitable for negotiating curves.

3.44 Portable or Towable Jib Crane

A crane which is suitable to travel under its own power and which has power driven hoisting motions or without power or hand derricking and/or slewing motions. This is mounted on either road or rail wheels (see Fig. 20).

3.45 Dragline Excavator

This is generally a track mounted crane of the fully slewing and luffing self propelled type, provided with an excavator bucket at the end of the main hoist line from the jib head and a haulage line from the bucket back to the winding mechanism at the foot of the jib. Such excavators may be converted to jib cranes by removal of the bucket and its haulage line, with or without alterations to the length of the jib.

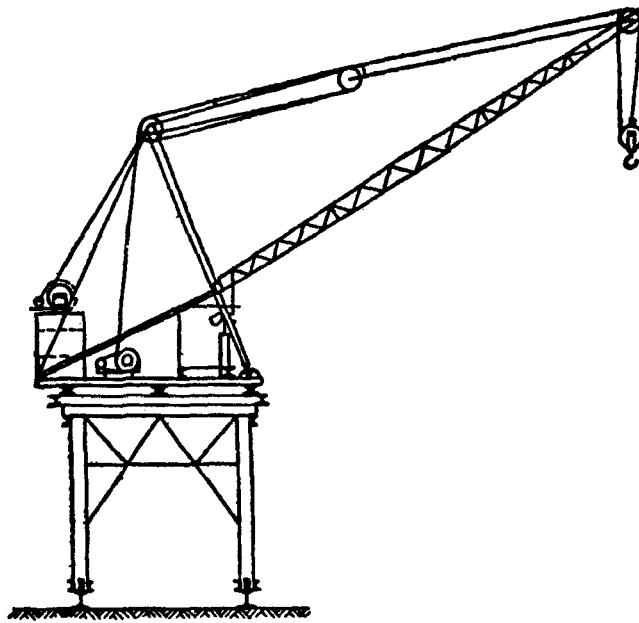


FIG. 20 PORTAL JIB CRANE

3.46 Cableway (Fixed Type)

This is a system of one or more catenary cables supported at each end by fixed towers or masts, provided with a travelling carriage (flying fox) and a hoisting mechanism located at either tower or mast, by means of which carriage the load may be raised, traversed and lowered. For this type, the load can be moved in a vertical plane only.

3.47 Cableway (Travelling Type)

This is a cableway otherwise similar to the fixed type but provided with either two travelling towers or one fixed and one travelling tower. For this type, the load can be moved in both vertical and horizontal planes.

4 RELATED TERMINOLOGY

4.0 This section covers terminology related with hoists and crane.

4.1 Basic Stresses

The stresses mentioned under the appropriate clauses and tables in the relevant standards, namely, IS 800, IS 807, IS 3177, etc.

4.2 Permissible stresses

The permissible stresses are the basic Stresses multiplied by duty factor and fluctuation factor as applicable and mentioned in the Indian Standards given in 4.1.

4.3 Dead Load

The weight of the crane structure steel work moving on the crane runway girders with all material fastened

there to and supported by it permanently or any load of constant magnitude, position or direction which acts permanently on the structure or member.

4.4 Live Load

The external static load variable in magnitude, position or direction with respect to the member of structure under consideration. It is also called working load or the load which varies in magnitude, direction and/or position and includes the working load and the inertia forces.

NOTE — The weight of the trolley (Crab) changes its position with reference to the crane structure, and is, therefore, to be considered as live load.

4.5 Safe Working Load/Rating/Capacity

The maximum external load excluding the weight of the lifting tackle, under the specified conditions for which the crane/hoist may be used. This may be variable quantity for a jib crane. If the grab forms an integral part of the suspended gear, then the weight of the gear shall also be included in the safe working load.

4.6 Rated Lifted Load/Applied Load

The external load lifted or handled by the crane/hoist. It includes in addition to the safe working load, the weight of lifting tackles, that is, handling devices magnets, lifting beams, hook blocks, wire rope etc, but excluding wind load and inertia forces.

4.7 Basic Wind Pressure

The horizontal component of the wind pressure produced on unit area of vertical surface in kg/m^2 .

4.8 Wind Load

The load due to wind pressure acting on the crane which is assumed to act horizontally.

4.9 Duty Factor

The factor which when multiplied by the basic stresses will take care of working period and effective load.

4.10 Fluctuation Factor

The factor which when multiplied by the basic stresses covers for failure in fatigue of members or connections at stresses lower than those at which they would have failed when under static load members.

4.11 Impact Factor

This factor applies to the motion of the hook load in the vertical direction and covers inertia forces including shocks.

4.12 Load Factor

The factor by which the load causing failure is to be divided to give the permissible load on the structure.

4.13 Factor of Safety

The factor by which the ultimate yield or the basic stress of the material of a member is required to be divided to give the permissible stress in the member.

4.14 Fatigue

The tendency of a member to fail (the failure usually initiated by a stress concentration) under repeated alternating or cycle stresses which may be below the ultimate tensile strength.

4.15 Fluctuating Stresses

A stress or combination of stresses which varies/vary in magnitude and direction. These are generally the combined effect of dead loads and live loads and are of two kinds.

- a) *Pulsating stresses* — Stresses which changes in magnitude without change in sign.
- b) *Alternating stresses* — Stresses which change in magnitude and sign.

4.16 Inertia Forces

The forces produced by acceleration or de-acceleration (braking, impact and bumping). These may be due to linear, radial, peripheral or centrifugal forces as defined below:

- a) *Linear forces* — Due to hoisting/lowering of load, travelling of crane, crab;
- b) *Radial forces* — Due to luffing of the jib;
- c) *Peripheral forces* — Tangential forces due to slewing of the jib, and
- d) *Centrifugal forces* — Radial forces due to slewing of the jib.

4.17 Dynamic Effect

The effect on the structure caused by inertia or sudden load application such as acceleration, de-acceleration, braking impact and bumping.

4.18 Over Loading

The load in excess of safe working load expressed as percentage of the later which the crane may be subjected to during testing.

4.19 Slewing Load

Forces induced with respect to the axis of rotation due to dead and live loads on the rotating parts of a slewing crane.

4.20 Erection Loads

All loads required to be carried by the structure or any part of it due to storage or positioning of construction material and erection equipment including all loads due to operation of such equipment, during the course of assembly and/ or erection.

4.21 Wheel Load

The maximum load on the wheel in the worst condition which includes the load due to the wind pressure but excludes the efforts of impact.

4.22 Tipping Load

The static load on hook which imposes stresses on centre pin/centre column of crane or causes any of the track wheels to leave the track before tipping or overturning about the tipping line occurs.

4.23 Tipping Factor

The ratio of the tipping load to the safe load. This may be expressed as a percentage of the safe working load also.

4.24 Tipping or Tilting

The overturning of crane.

4.25 Stress Concentration

The localized increase of stress in a member or component due to change of section or other causes.

4.26 Service Conditions

A crane shall be deemed to be under service conditions when it is handling in any or all its motions a load upto and including the maximum load for which the crane has been designed and, where exposed to wind is subject to the stresses resulting from the wind velocity specified for the safe operation of the crane.

4.27 Life Span or Life Expectancy

The probable life of the equipment under specified service conditions normally specified in working hours.

4.28 Speeds

The various speeds are defined as under:

- a) *Gear speed* — The speed attained by any crane motion when the driving motor is running at its rated speed.
- b) *Balancing speed* — The constant speed attained by the crane motion after the acceleration is complete.
- c) *Working speeds* — The operating speeds for the crane are defined below:
 - 1) *Hoisting speed* — The maximum steady speed at which the safe working load is lifted.
 - 2) *Lowering speed* — The maximum lowering speed at which the safe working load is lowered.
 - 3) *Long travelling speed* — The maximum speed at which the fully loaded crane or crab is stated to travel.
 - 4) *Cross travelling speed* — The maximum speed at which the fully loaded crab is stated to travel.

4.29 Motions

The various motions of the hoists are defined as under :

- a) *Main hoist motion* — The motion which raises or lowers the load (the full load), the crane is authorized to carry. The motor doing this work is termed as hoist motor.
- b) *Auxiliary hoist motion* — When an additional hoisting motion smaller than the main hoisting

motion is embodied in a crane, it is known as an auxiliary hoist motion and its motor is termed as auxiliary hoist motor.

- c) *Cross traverse motion* — The motion of the trolley or crab across the crane span is known as the cross travel motion and the motor causing this motion is termed as cross traverse motor.
- d) *Longitudinal travel motion* — The motion of the whole crane on its gantry or tracks is known as longitudinal travel motion and the motor causing this motion is termed as longitudinal travel motor.

4.30 Hoisting

The motion of lifting or lowering of the load in a vertical direction.

4.31 Clearance Lines

Lines defining the area within which the crane should be designed to work. Building and other fitments should not encroach the lines.

4.32 Clearance Diagram

Diagram indicating mandatory clearances (see Fig. 21 and Fig. 22).

4.33 Headroom for E.O.T. Crane

The vertical distance from the top of the crane gantry rail to the topmost overhead obstruction.

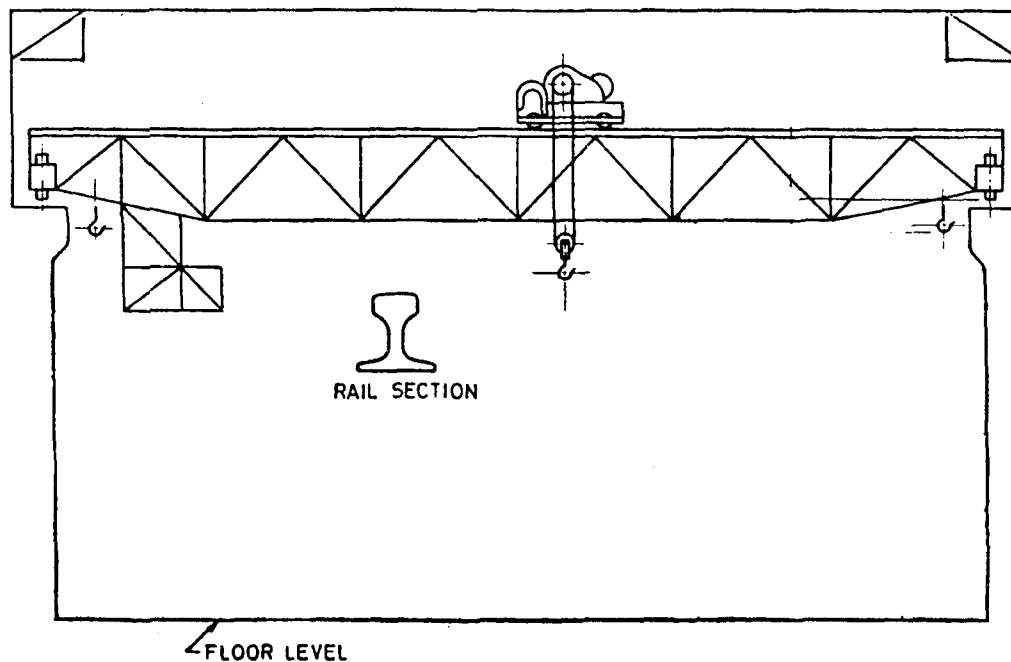
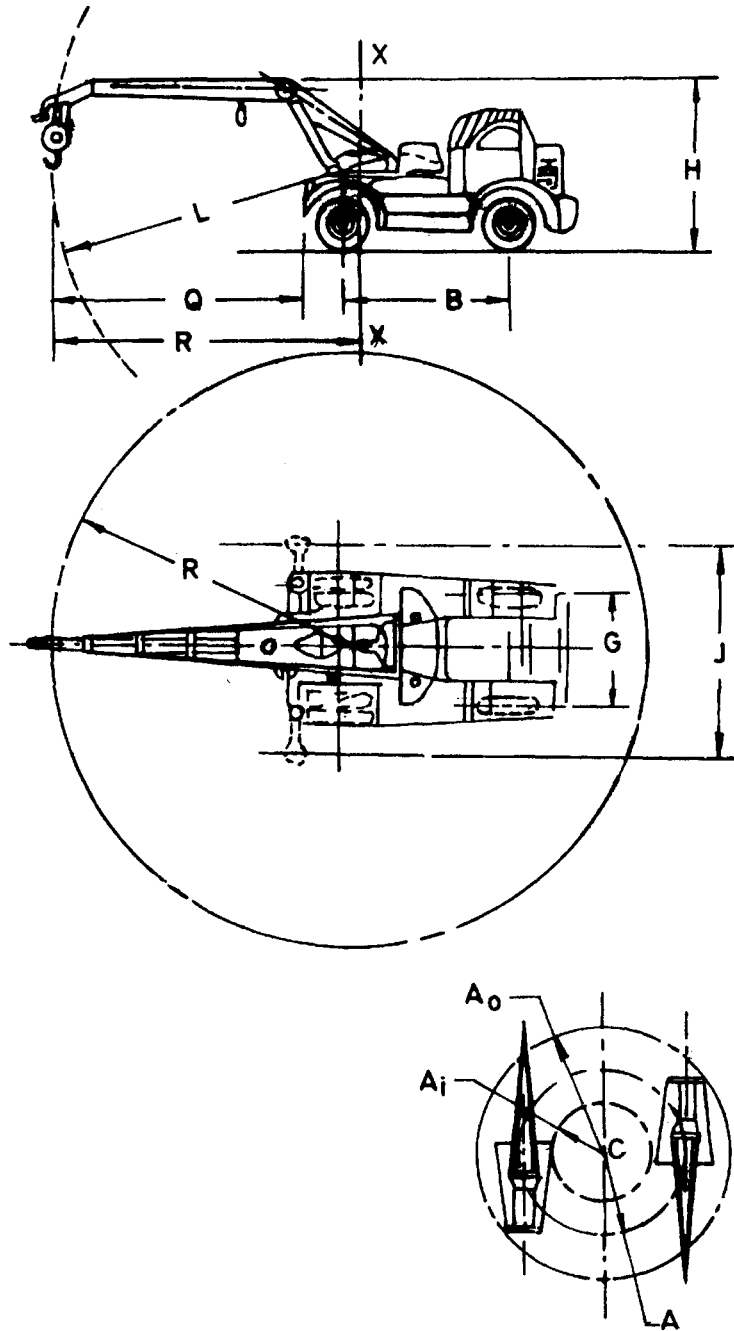


FIG. 21 OVERHEAD TRAVELLING CRANE (CLEARANCE DIAGRAM)



H	= Headroom	G	= Wheel centres
L	= Luffing radius	J	= Blocked up base
Q	= Outreach	A	= Turning radius
B	= Wheel base	A_i	= Inner turning radius
R	= Radius	A_o	= Outer turning radius
$X-X$	= Slewing axis	C	= Turning centre or Turning axis

FIG. 22 JIB CRANE CLEARANCES

4.34 Hookend Approaches

The minimum distance from the centre of the hook to the centre of the gantry rails at either ends of the crane.

4.35 Height of Lift

The vertical distance between the floor and the lowest point of the seat of the hook, when the hook is in the highest working position (*see* Fig. 12 and Fig. 16).

4.36 Range of Lift

The distance between the two extreme positions of the hook, that is the highest and the lowest position of the hook (*see* Fig. 1).

4.37 Headroom for Chain Pulley Block

The distance between the saddle of the load hook and the suspension level when the load hook is in the highest position (*see* Fig. 1).

4.38 Suspension Level

The level of the suspended hook saddle in case of a block suspended from a hook and in the case of a block combined with a trolley, the level of a surface on which the trolley runs. In other cases similar appropriate level (*see* Fig. 1).

4.39 Extended Dimensions

The distance between the suspension level and the bottom hook saddle, when the bottom hook is in the lowest operating position.

This is equal to the sum of the headroom and the range of lifting (*see* Fig. 1).

4.40 Chain Pull

Average effort in kilogram-force exerted by the operator on the hand chain to lift the rated load and keep it in motion.

4.41 Velocity Ratio

The ratio between the velocities of hand chain and load. It is equal to the number of metres, the hand chain has to be moved to raise or lower the hook through a distance of one metre.

4.42 Factor of Safety for Chain Pulley Block

The ratio between the ultimate strength of pulley block as a unit and the rated load. It should not be less than 5. It also covers the additional stress caused by frictional resistance and acceleration of the load under normal service condition.

4.43 Ultimate Strength

Ultimate strength of the pulley block is the maximum load on the load hook under which the load chain or any other component of pulley block gives way.

4.44 Competent Person

The person who is approved and declared as such under the relevant statutory provisions.

4.45 Load Brakes

All drive shafts are provided with an automatic mechanical load brake which will prevent self lowering of the load and arrest and sustain load in all working positions. The load brake should also allow smooth lowering of the load without serious over heating which may impair efficient working of the brake (*see* Fig. 23).

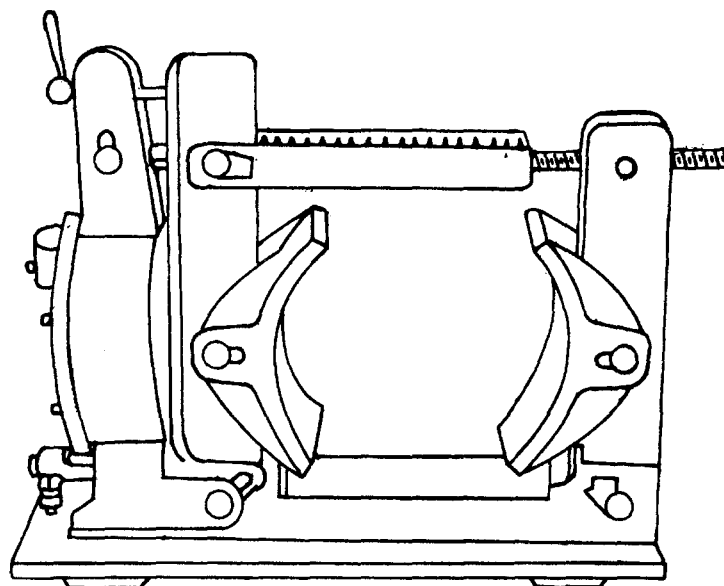


FIG. 23 ELECTRO MAGNETIC BRAKES

4.46 Ratchet Wheel and Pawl

This arrangement should be of sufficient strength to arrest the full load from lowering due to gravity when manually lifted (*see* Fig. 24).

4.47 Proof Load

It is specified (about one and a half times) load to which each chain pulley block is subjected to test by the manufacturer through a length of lift which will ensure that every part of the brake mechanism and each tooth to the gears comes under load.

4.48 Headroom for Electric Wire Rope Hoist

Measured with load hook in the highest position with full load and it is the distance between the saddle of the load hook and the following points:

- The top of the lug or centre line of suspension holes or lug suspension hoists.
- The bottom of beam or rail on trolley suspended hoists.
- The saddle of the top hook or hook suspended hoists.

4.49 Test Pressure

Test pressure is specified pressure at which the hoist is tested with overload relays appropriately set.

4.50 Trolley

A truck or carriage on which the hoist is mounted. The trolley may be moved by pushing, hand geared or motor driven type.

4.51 Drum

The cylindrical member around which the rope for raising and lowering a load is wound (*see* Fig. 25).

4.52 Factor of Stability

The ratio between the stabilizing moment of the crane to the overturning moment caused due to loading on the crane about the line on which overturning is considered.

4.53 Stability Base

The effective span of the supporting base (*see* Fig. 26 and Fig. 27).

4.54 Stability Reach

The distance of the jib head pin from the point of intersection of the nearest base line and vertical plane through the centre line of jib. (The dimension will vary for different positions of the hook in the course of one revolution during slewing but for the purpose of calculating the stability, the maximum value of this dimension is taken.) (*see* Fig. 26 and Fig. 27).

4.55 Wheel Base

The distance between the wheel centres along the direction of motion. Where there are more than two wheels the wheel base shall be taken as the distance between the outside wheels (*see* Fig. 22).

4.56 Wheel Centres

The distance between the wheel centres across the direction of motion (*see* Fig. 16 and 22).

4.57 Blocked Up Base or Blocking Up Base

The effective span of the supporting base as modified when outriggers or other means are used to increase stability (*see* Fig. 22).

4.58 Outreach/Reach

It is the horizontal distance from the centre line of the (luffing) hook to the nearest point on the crane chassis,

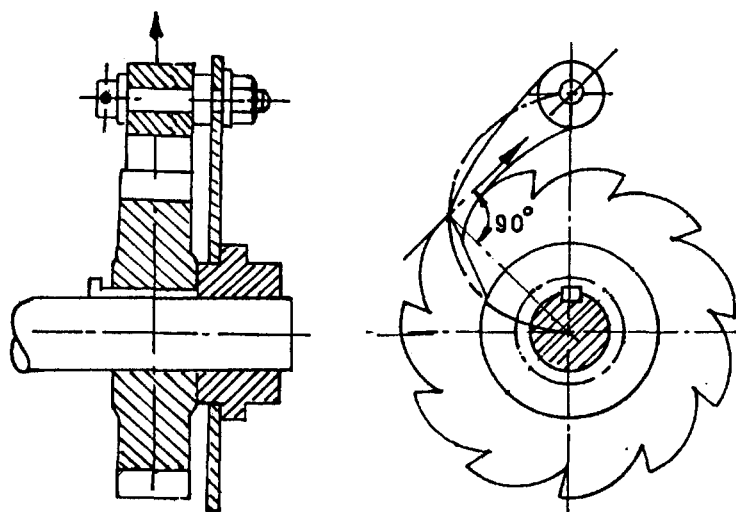


FIG. 24 RATCHET WHEEL AND PAWL

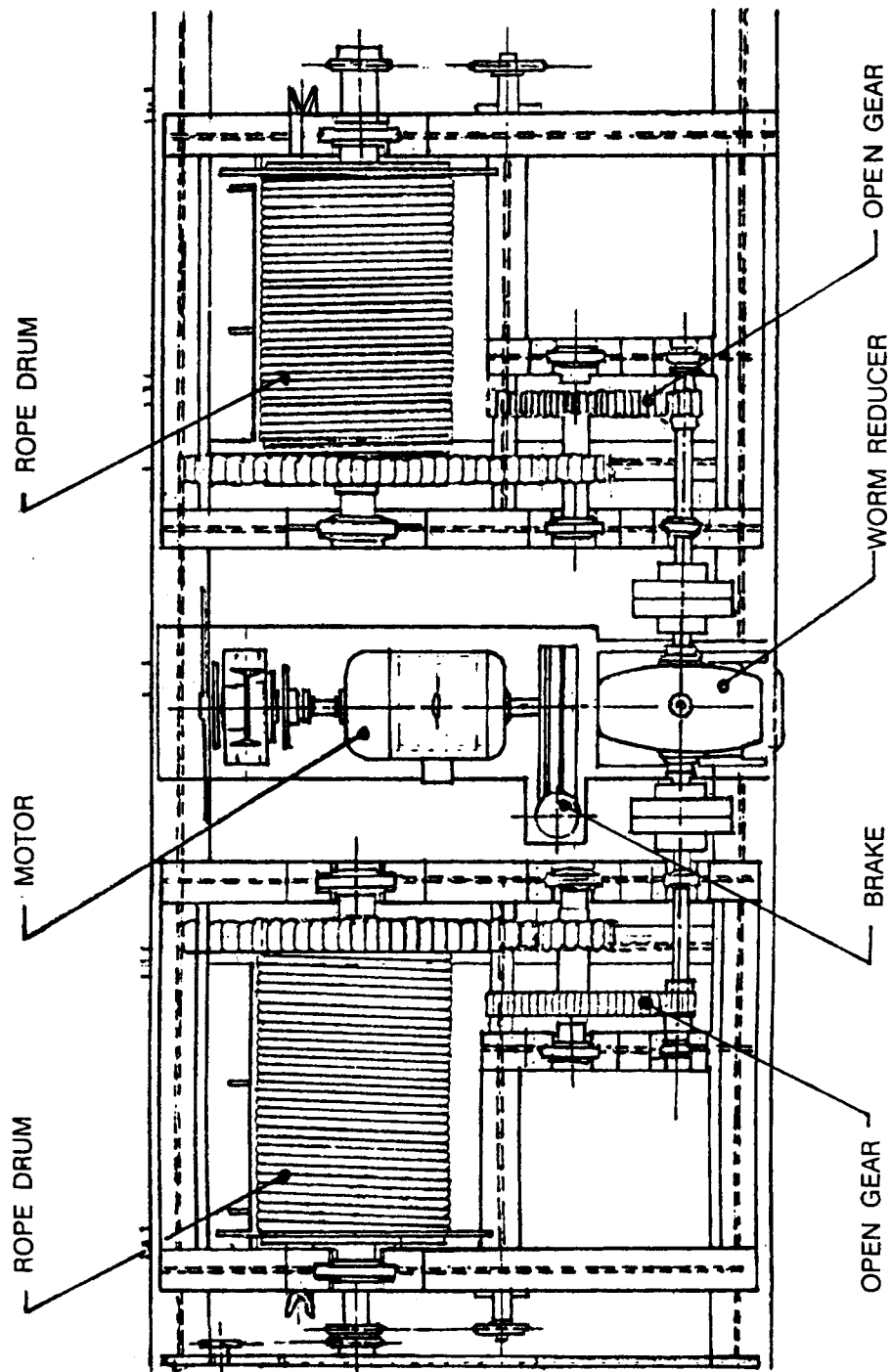


FIG. 25 ROPE DRUM HOIST (PLAN)

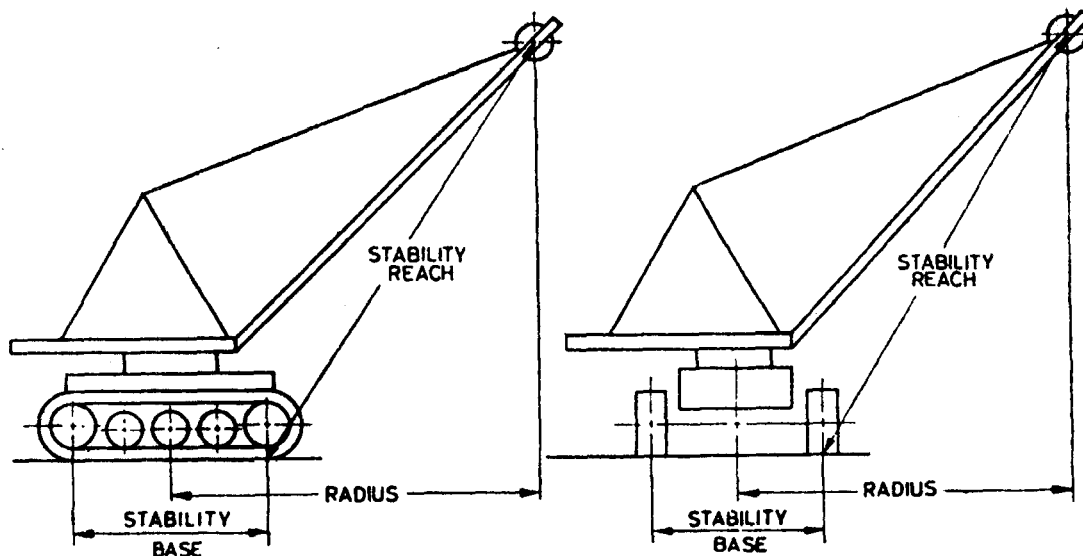


FIG. 26 PORTABLE CRANE—STABILITY BASE AND STABILITY REACH

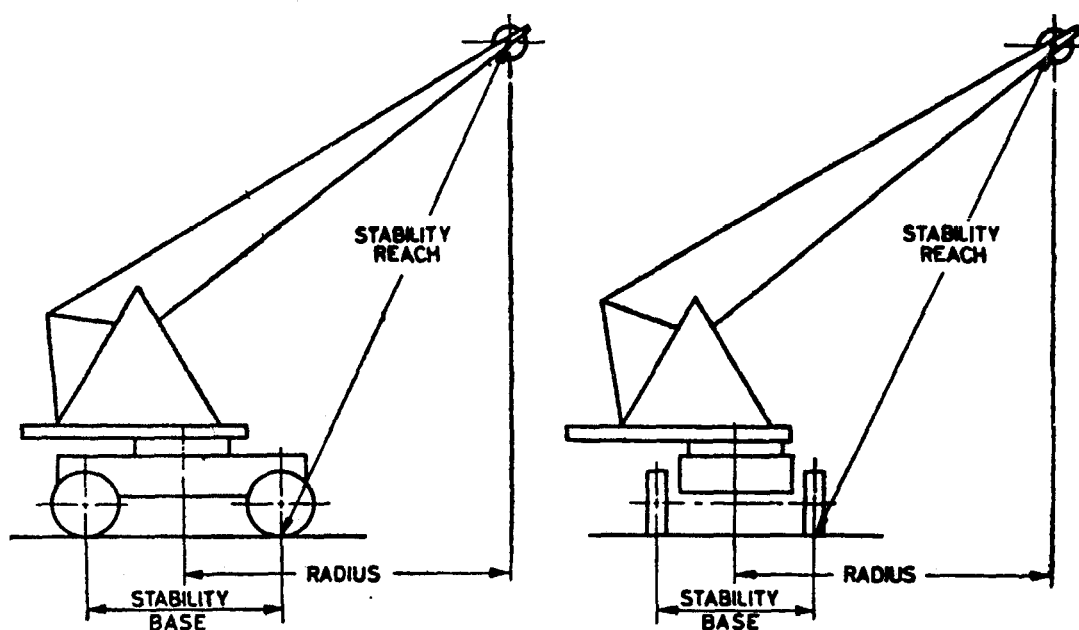


FIG. 27 TRUCK MOUNTED CRANE— STABILITY REACH, STABILITY BASE AND RADIUS

or base of an under carriage or in the case of a non-slewing crane to the nearest point of the base (see Fig. 22).

4.59 Radius

The horizontal distance from the centre line of the lifting hook to the centre about which jib slews or, in the case of a non-slewing crane the horizontal distance from the centre line of lifting hook to the nearest base line (see Fig. 22).

4.60 Span

The horizontal distance between the centres of the crane track.

4.61 Slewing

The rotary motion of a crane jib or load about vertical axis.

4.62 Slewing Axis or Slewing Centre

The axis or point about which the slewing motion takes place (see Fig. 22).

4.63 Slewing Range

Slewing range of the jib is measured in degrees.

4.64 Slewing Speed

Slewing speed of the jib is measured in rev/min. It can also be expressed in metres per minute when referred to a particular point on the jib for example jib end.

4.65 Jib Length

The maximum distance between the centre line of the lifting hook and the centre about which the jib slews (see Fig. 12 and 16).

4.66 Climb

The capacity of a crane to travel up a gradient measured either in percentage of a gradient or in degrees.

4.67 Luffing Radius

The maximum horizontal distance from the centre line of the lifting hook to centre about which the jib slews (see Fig. 22).

4.68 Level Luffing

The motion during which the crane hook moves horizontally and maintains uniform height level throughout.

4.69 Luffing or Derricking

The angular movement of the crane jib in a vertical plane.

4.70 Luffing Distance

The distance through which the load travels during the luffing of the jib (see Fig. 12 and 16).

4.71 Luffing Line

The path of the load hook during the luffing operation.

4.72 Luffing Speed

The speed at which the load travels during luffing of the jib. This is measured in metres per minute in case of level luffing cranes and in the case of non-level luffing cranes it is measured in terms of the time taken for moving the jib from the lowest position to the highest position.

4.73 Racking

The motion applied to a carriage travelling along a crane jib.

4.74 Tail Radius

The maximum distance between the centre of rotation and the 'Tail' or rear most point of the revolving superstructure (see Fig. 16).

4.75 Turning Centre or Turning Axis

The point or axis about which the crane moves in an arc (see Fig. 22).

4.76 Turning Radius

The distance between the slewing centre of the crane and turning centre of imaginary point about which the crane moves in an arc (see Fig. 22).

4.77 Inner Turning Radius

The distance between the innermost point of the crane and the turning centre (see Fig. 22).

4.78 Outer Turning Radius

The distance between the outermost point of the crane and the turning centre (see Fig. 22).

4.79 Crane Bridge

The structural unit or part of the crane, comprising a girder or girders, which spans the gantry and is rigidly connected to the end carriages containing the longer crane travel wheels running on the gantry.

4.80 End Carriage

The structural unit or part of crane, comprising of steel sections to which the crane bridge is rigidly connected. The end carriage houses the longer crane travel wheels.

4.81 Crab (Manually or Power Operated)

A carriage supported on four or more wheels for over or under slung running on a crane bridge girder (s) fitted with driving means for the traversing and hoisting motions. Power operated crabs may be controlled from pendant push buttons or from an operator's cabin attached to the crab or crane structure.

4.82 Crab Control

Controls may be operated either by floor control unit, or from the driver's cabin which may be attached either to the crab or the crane structure.

4.83 Bottom Block

The complete assembled unit comprising of the load hook with thrust bearing and wire rope sheaves and related components.

4.84 Control Gear

These are electrical equipment used for controlling the various motions of the crane.

4.85 Cab Control

The arrangement by which the various movements of the crane are controlled from the driver's cabin.

4.86 Floor Control

The arrangement by which several motions of the crane are controlled from the floor.

4.87 Jib

A structural member pivoted at one end and capable of luffing (derricking) which retains the reaction of the rope between the suspended load and the rope drum of the hoisting gear.

4.88 Derrick Crane King Post (Mast)

A normally vertical structural member rotating in top and bottom bearings to which the lower portion of the jib is hinged.

4.89 Superstructure

The part of a slewing or part slewing crane which rotates about the vertical axis.

4.90 Lifting Magnet

An electromagnet made of high permeability steel, energised and controlled from a suitable source of direct current to hold, lift and transport ferrous materials (magnetic) in various forms, such as slabs, billets, plates, scraps skull, cracker balls etc. The magnet is generally of circular or rectangular shape and may be of bolted or coiled construction.

4.91 Electrical Characteristics

Clearly specified electrical characteristics consisting of voltage, phases, cycles if alternating current is used and voltage only if direct current is used.

4.92 Limit Switch

A device to cut off the power automatically at any desired limit of travel.

4.93 Electrically Operated Brake

A friction brake actuated or controlled by electric means (*see* Fig. 23).

4.94 Electric Brake

An electric motor acting as a brake by re-generative-counter torque or dynamic means.

4.95 Conductor or Bushbars

Means of supplying electric current to crane bridge and/or the crab, the conductors running parallel to runway track and being carried on insulation. The supply to the crane bridge and/or crab is collected from conductors by current collectors rigidly fixed to the crane bridge/or crab. The current collection will be of the spring loaded type, employing carbon or metal blocks or gravity type cast iron shoe collectors in the case of rigidly fixed conductors, or roller or sweeping contacts in the case of conductors strung between end strainers and resting on support insulators.

4.96 Pantograph Type Spring Loaded Current Collectors

A means of collecting electric current from a system of rigid wires of bars strung between strainer insulations and rigidly supported by intermediate support insulators for supply to the crane bridge or crab. The current collector is spring loaded and has a triangular carbon block for current collection purposes. The spring loading makes the carbon block exert a positive pressure on the current collection wires. The pantograph arrangement enables the movement of the carbon block on an axis perpendicular to the axis of support, thus enabling, the current collector to adjust itself to alignment and structural irregularities without break of contact (*see* Fig. 28).

4.97 Reel or Wheel Type Current Collector

This type of current collector is used on a system of current collector wires loosely strung on and strainer

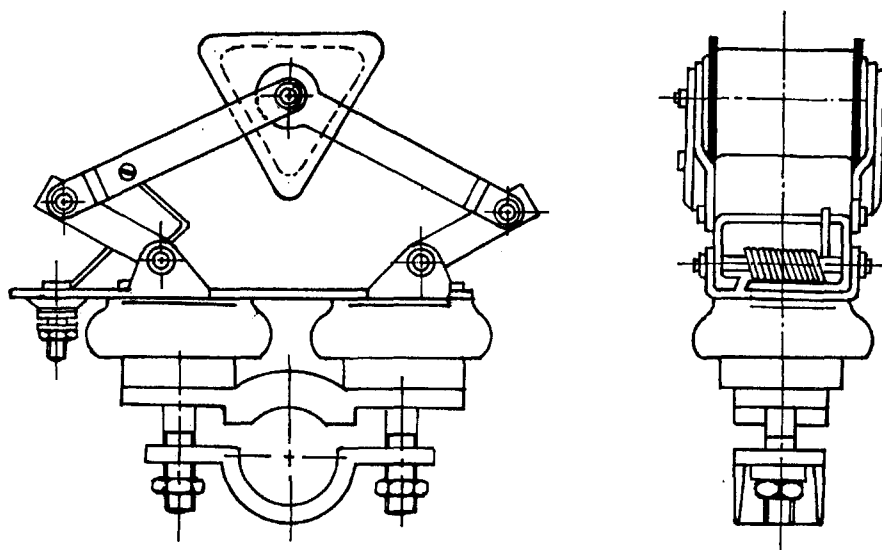


FIG. 28 SPRING-LOADED CURRENT COLLECTOR

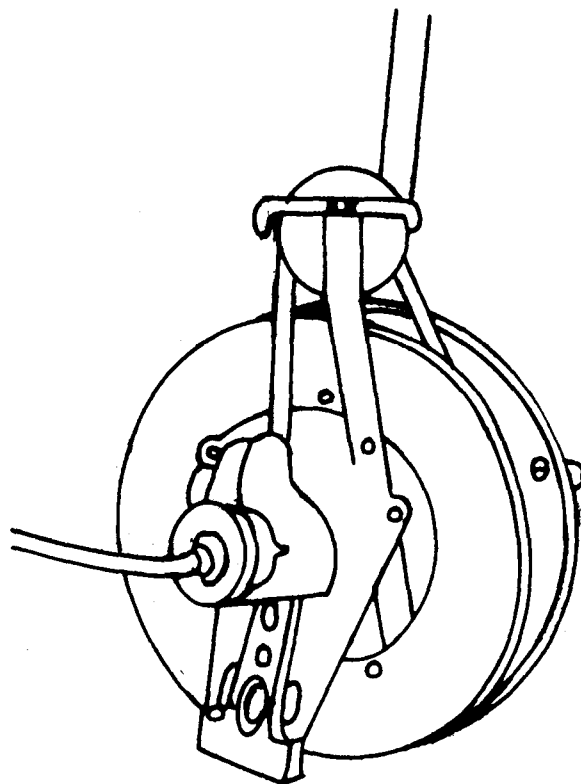


FIG. 29 SPRING CABLE DRUM

insulators resting on support insulator brackets, the reel or wheel type collector rotating on a pin fixed to an insulator and sliding beneath the collector wires.

4.98 Protected Conductor

Protected conductor is a conductor insulated by a suitable insulating cover except for a small opening underneath to allow the carbon pickup to collect the current. This is a simple electrical feed which gives the same reliable service as open conductors but with complete safety. The protected conductor are extremely versatile and may be used either indoor or outdoor.

4.99 Festooned Cables

Means of supplying current to the crane equipment of limit length, that is, traverse span or short runways through the medium of flexible cables running parallel with the track. The flexible cables train is suspended from a light auxiliary track or taut wire and the 'festooning' is taken up as the block moves away from the fixed end of the cable.

4.100 Spring Cable Drums

Means of supplying current to the crane equipment through the medium of flexible cable being drawn of a spring loaded drum. The cable drums may be fixed or swiveling type and are positioned to suit the path of the runway (see Fig. 29).

4.101 Gate Position Indicator

A rotary or linear position indicator is linked to the moving parts of the gate to indicate its position in its full travel.

4.102 Gate Hoist Connections

The component used for connecting the stems between the gate and hoist is known as gate hoist connection. It is generally of the following types (i) clevis type, (ii) split collar type, (iii) hook and eye type (see Fig. 30).

4.103 Directional Control Valve

It directs the oil where to go by opening and closing the passages. They are of the following types:

- a) *Check valve* — It is also called one way valve because it permits only one flow path.
- b) *Reversing valve* — It is called four way valve because it has four flow paths.

4.104 Actuator

It converts pressure energy to mechanical energy. Cylinder/Ram is a linear actuator and its outputs are force and straight line motion. A motor is a rotary actuator and its outputs are torque and rotating motion.

4.105 Self-Coiling Cable

Flexible multicore cable in the form of a close coiled extensible helix.

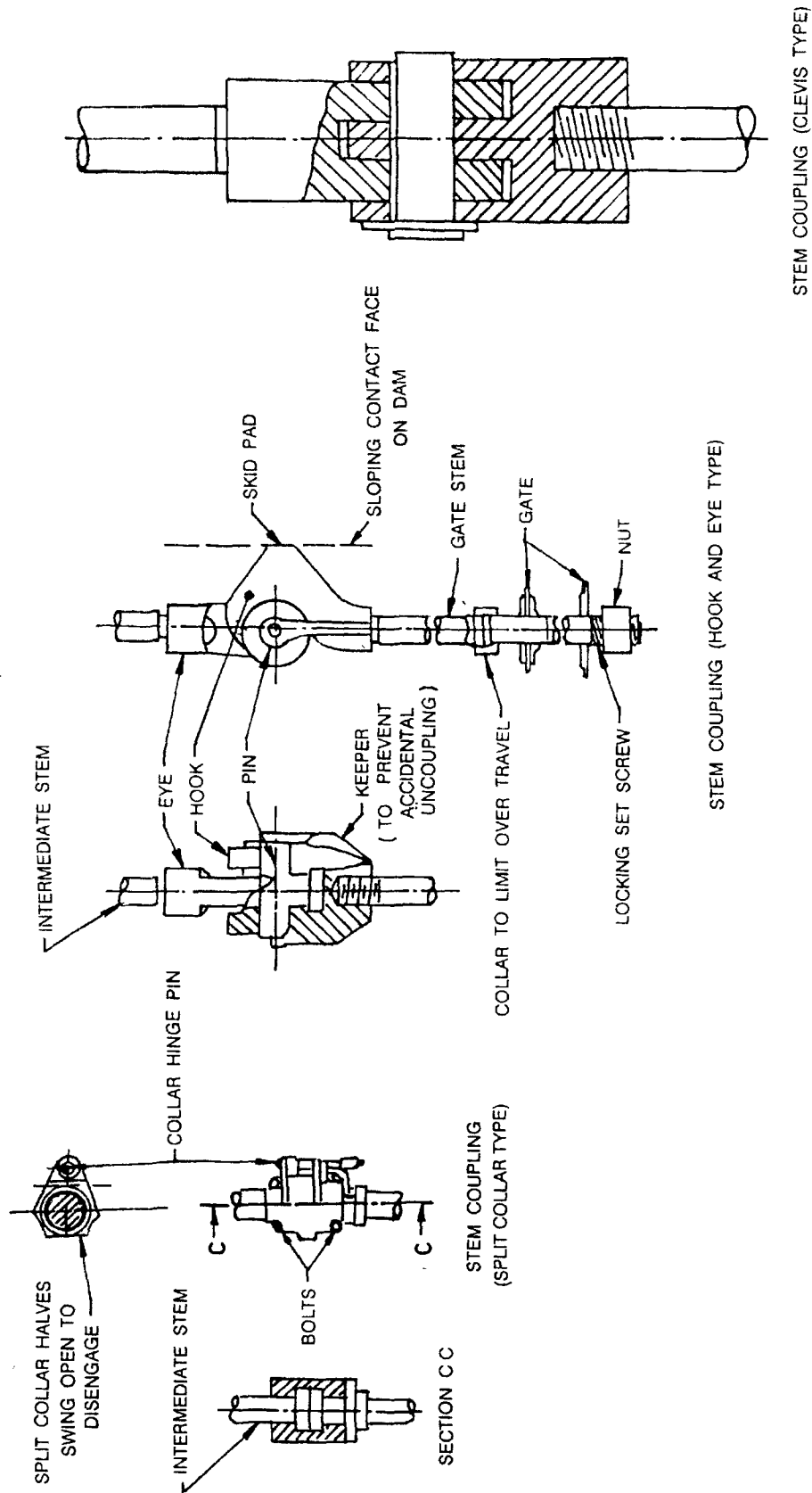


FIG. 30 VARIOUS TYPES OF GATE HOIST CONNECTIONS

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Amendments Issued Since Publication

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